EGG AND FIRST-STAGE LARVA OF TARSOSTENUS UNIVITTATUS (ROSSI), A BEETLE PREDACIOUS ON POWDER-POST BEETLES [1]

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INTRODUCTION

The family Cleridae has long been recognized as one of considerable economic importance because of the predacious habits of the beetles, both in the larval and adult stages. Champlain (*1*)[2] states that "they are among the principal predators of wood and bark boring beetles, the adults attacking the adults of the destructive species while the larvae feed upon the eggs and broods in the bark and wood." And he continues:

"Under natural conditions they may be of but normal importance but can be turned to considerable account in control measures with the additional help of man, who can overbalance the natural conditions in favor of the predators by properly conducting control work."

The beetle *Tarsostenus univittatus* (Rossi)[3] is one of the clerid species and, according to Champlain (*1*), principally a predator on powder-post beetles such as Lyctus and Xylobiops (=Sinoxylon) in dry, seasoned wood products.[4] Of this species several living adults were obtained while the writer was supervising a series of experiments which were recently conducted by the Bureau of Entomology in cooperation with the Naval Aircraft Factory at the League Island Navy Yard, Philadelphia, Pa., to determine temperatures fatal to the powder-post beetle *Lyctus planicollis* Le Conte by steaming infested ash and oak lumber in a kiln (*5*). Additional infested ash lumber was sent to the Forest Insect Laboratory, East Falls Church, Va., and several adult beetles were secured from this material to be placed in cages for rearing.

TRANSFORMATION TO ADULTS AND MATING

Most of the beetles probably pass the winter in the larval stage, although a few may pupate before early spring, especially if they are in wood which is kept in a heated building. In December, 1923, samples of infested wood were placed in a heated building and were kept at a temperature of 70° F., or slightly higher. When examined five weeks later, most of the beetles were in the larval stage, but two pupæ and three maturing adults were found. This is in accordance with the statement of Champlain (*1*) that "clerids overwinter sometimes in all stages, and sometimes only in a certain stage. The time of transformation to adults is generally in the spring, but it varies." Thus the first adults emerged from the cages containing the infested lumber during the early part of February.

Probably the adults of *Tarsostenus univittatus* emerge about the same time as those of their host, *Lyctus planicollis*, for Snyder (*3, p. 14, 4*) records that adults of the latter emerged as early as January 12 in a heated building in the vicinity of Washington, D. C., that their general appearance occurs about the middle of April, the maximum emergence from the last of April to the first of June, and the last emergence during the first part of July. All these data coincide with corresponding data for *Tarsostenus univittatus*, as far as observations have been made.

The mating usually occurs shortly after the adults emerge.

OVIPOSITION

Oviposition begins a day or two after the adults emerge from the wood and mate. The beetles were observed to crawl into the entrance galleries of their host, and it is likely that eggs were deposited there. According to Champlain (*1*) "they may be placed in or near the entrance gallery of their

[1] Received for publication April 22, 1924—issued—January, 1925.

[2] Reference is made by number (italic) to "Literature cited," p. 51.

[3] Order Coleoptera, family Cleridae.

[4] That the larva does not confine itself to attack on a single host is suggested by the observations of the present writer, who saw a mature larva in rearing crawl over the surface of the wood and enter a gallery of Lyctus from which powderlike borings were being ejected. Altogether, a large percentage of their host must have been killed by the attacks of the beetle, both in the larval and adult stages.

host." In order to observe the process of oviposition three adults, two females and a male, were placed in a small vial which contained a porous stopper. In this way oviposition was observed without much difficulty. The female, before inserting the egg, spends considerable time moving from place to place, with the ovipositor extended, to find a suitable opening. The ovipositor is nearly as long as the body. It terminates in two slender, palpilike processes which are used to locate the desired opening. When such a place has been found the end of the body is placed close to the opening and the ovipositor is inserted into the cavity.

THE EGG

The egg (fig. 1, *a*), in many respects, bears a rather striking resemblance to that of its host, *Lyctus planicollis* (fig. 1, *b*). In fact, when seen in a pore in the wood, it might easily be mistaken for the latter. It (fig. 1, *d*) is elongate, cylindrical, rounded at the posterior end and drawn out into a slender strandlike process at the cephalic end. It is grayish-white in color, somewhat shiny, 0.85 mm. long without the strandlike process, or 1.2 mm. with this process included, and 0.123 mm. in width. The egg of *Lyctus planicollis* is slightly smaller, being 1 mm. long with

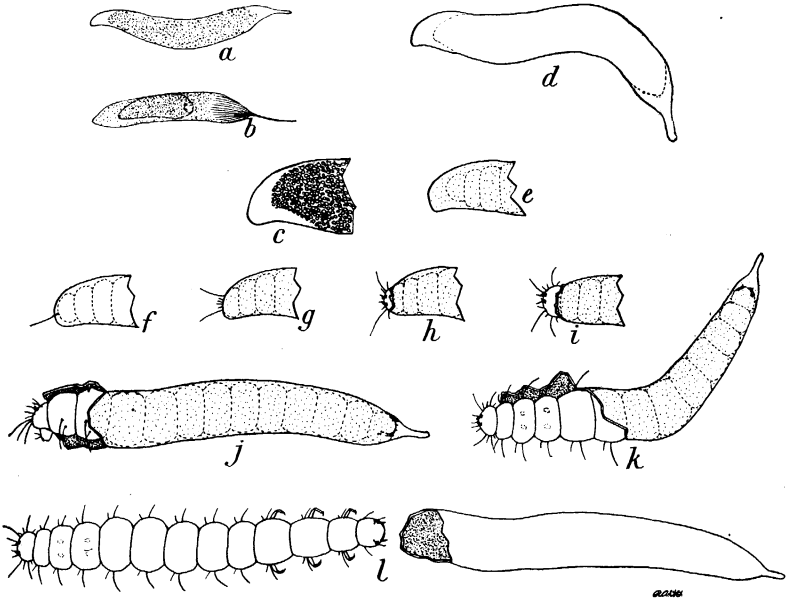

FIG. 1.—*Tarsostenus univittatus: a*, Egg with newly formed embryo; *c*, greatly enlarged view of end of egg, showing granular appearance; *d*, outline of egg, showing strandlike attachment; *e*, part of egg, showing dorsal view of 6th, 7th, 8th, and 9th abdominal segments of larva ready to hatch; *f–k*, larva hatching from egg, liberating first the caudal setae and then the abdominal segments; *l*, larva free from eggshell, and the empty shell. *Lyctus planicollis: b*, Egg with larva ready to hatch, drawn to same scale as *a*.

After a short time, during which a pumping movement was noted in the ovipositor, the egg was inserted into the pore. In one instance seven minutes elapsed before the process of ovipositing was completed. Upon examining the stopper three days later seven eggs were found. They were all inserted in the same cavity, side by side, probably for the simple reason that it was the most favorable place. It is quite likely that under natural conditions from one to three eggs would be deposited in a pore, as is the case with Lyctus.

the process (fig. 1, *b*). The process resembles that on the eggs of *Lyctus planicollis*, and of the bostrychids *Scobicia declivis* Lec. (*2*) and *Xylobiops basilaris* (Say). It has a granular appearance (fig. 1, *c*) like that of Lyctus but differs from the latter by the absence of the longitudinal striae on the end which bears the process. As is the case with the above mentioned eggs which it resembles, the end bearing the strandlike process leaves the ovipositor last.

After the egg is a few days old the formation of the larva within can be

seen, especially when the latter moves. It occupies nearly the entire egg. After a period of incubation of about 10 days the larva becomes quite active and is ready to emerge. It twists and turns, causing the closely-fitting eggshell to follow the movements of its body. At that time, just before hatching, part of the segments assume a violet tint and the mandibles can now be seen.

The process of hatching is a very interesting one and is accomplished in a manner which again is similar to what we find in *Lyctus planicollis* (fig. 1, *e–l*).

When ready to emerge, the larva begins to push against the posterior end of the egg by alternately contracting and expanding its body (fig. 1, *e*). The ninth abdominal segment is armed with stiff setae which are used for piercing the eggshell. First one (fig. 1, *f*) and then several setae may be seen protruding through the end of the shell (fig. 1, *g*). Next, the abdominal segments may be seen gradually working themselves out (fig. 1, *h–k*), until finally the larva frees itself completely and starts to crawl about (fig. 1, *l*).

Under natural conditions the entire process of emerging probably takes less than an hour, but in the laboratory, when the eggs were placed in a plaster cell and little opportunity given for holding the shell in place, it took three hours. When, however, the cephalic end of the shell was held fast the process was completed in considerably less time. From this fact it occurred to the writer that the reason why eggs of this type have the peculiar strandlike process at the cephalic pole is that it enables the adult to attach the strand to the wood in order that the egg can be held in place while the larva emerges. In one instance a larva was unable to emerge from the egg after twisting and turning for a long time, presumably owing to the fact that the egg was not held in place.

THE FIRST-STAGE LARVA

The first-stage larva is armed with setae which are much longer than in the mature specimens.[5] When the larva is in the egg these setae are pressed close to the body, but as soon as the segments are free from the eggshell the setae straighten out. The newly hatched larva is nearly white except for the violet markings on the segments; the ampullae are slightly developed on the terga of the 6th and 7th abdominal segments, a characteristic also of the mature larva. The mandibles, cerci, and claws are lightly chitinized, and four ocelli are present on each side of the head, also as in the mature larva. It has not been possible to find any spiracles.

SUMMARY

Tarsostenus univittatus (Rossi) belongs to the family Cleridae, which is of considerable economic importance because of the predacious habits of the beetles in both the larval and adult stages. Several adults were reared from ash lumber infested with the powder-post beetle *Lyctus planicollis* Le Conte, on which it is known to be predacious.

Under normal conditions the beetles pass the winter in the larval stage and adults emerge in the spring about the time the powder-post beetles appear.

Oviposition begins soon after the adults mate; elongate, cylindrical, grayish-white eggs, which possess a peculiar strand-like process on the cephalic end, are deposited in or near the entrance gallery of their host. The process is probably attached to the wood to hold the eggshell in place while the larva emerges. After a period of incubation of about 10 days, the larva hatches from the egg by backing out, freeing itself by using its long, stiff caudal setae to pierce and break the posterior end of the shell.

The first-stage larva differs from the mature form in that the setae are much longer, but resembles it in having violet-colored markings on its segments; ampullae present on the sixth and seventh terga; the mandibles, claws, and cerci lightly chitinized; and four ocelli on each side of the head.

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[5] A. G. Böving (*1*) has described and figured the mature larvae of this family.